ISO-C1®/2.0 Polyisocyanurate Insulation
2.0 lb/ft³ (32.1 kg/m³) Density Foam

ISO-C1®/2.0

ASTM C591-17

FM Approvals Listed Identified Component Combustible Core Insulation

MIAMI-DADE COUNTY

ISO-C1/2.0 is Dyplast's cornerstone polyisocyanurate rigid foam insulation within its broad ISO line of products. ISO-C1/2.0 is independently tested and audited, and is listed with FM as a Specification Tested Identified Component - Combustible Core for Insulated Building Panels under FM 4880. ISO-C1 has higher thermal efficiency than competing polyiso, EPS, XPS, fiberglass, or cellglass insulation, offering exceptional performance in both piping and panel applications from -297 to +300°F (-183 to +149°C). ISO-C1 physical properties are superior in other areas, achieving code compliance plus levels of dimensional stability, closed cell content, and moisture resistance otherwise unattainable. ISO-C1/2.0 meets the demanding requirements of ASTM C591-17, including thermal conductivity measurement down to -200°F (-129°C). [Dyplast's ISO-C1/2.5 meets CINI Standards (the International Standard for Industrial Insulation), often required for LNG (Liquid Natural Gas) facilities.]

ISO-C1 is produced as a continuous foam bunstock with the ability to custom size the bun in order to provide for fabrication to virtually any shape or size, thus reducing waste. For specific stock bun sizes contact the sales department at 1-800-433-5551 or logon to our website for ISO-C1 sizing. Our proprietary production process utilizes hydrocarbon blowing agents creating a portfolio of ISO-C1 products with physical properties superior to prior generation formulations.

THERMAL EFFICIENCY

With its high R-value, ISO-C1/2.0 can achieve the same insulating value with as little as half the thickness required by alternative insulating materials. Less insulation leads to thinner walls, less weight, more space, and fewer and tighter energy-losing seams - - further enhanced by the availability of larger pieces (for example, 24-foot panels or blocks). Less insulation in mechanical applications also equates to reduced quantities of expensive vapor retarders, jackets, and mastics. The lighter weight of ISO-C1/2.0 compared to cellular glass (less than one-third) reduces structural support requirements.

LONG TERM R-VALUE

High thermal insulation efficiency is achieved by infusing cells with gases having low thermal conductivity. All such rigid foam insulation (including polyurethanes and extruded polystyrene) thus lose a small amount of their insulating value over time as air displaces insulating gases. ISO-C1's smaller, stronger cell structure and our proprietary cell-gas formulation work together to impede gas transfer across cell boundaries, thus reducing loss of thermal efficiency. It is important to note that ISO-C1/2.0's service temperatures are normally well below 75°F, and that thermal aging is reduced considerably at lower operating temperatures. Thicker insulation, vapor barriers, and metal jacket constraints also limit gas diffusion. Long Term Thermal Resistance calculation standards were designed for faced polyiso sheets are not accurate for ISO-C1/2.0 bunstock, particularly as-installed in low temperature applications.

WATER ABSORPTION (WA)

Water absorption by insulation can degrade thermal insulating performance. ISO-C1/2.0's excellent resistance to water absorption (0.47%) as measured in accordance with Test Method ASTM C272 helps ensure long-term thermal performance. Proper installation of vapor barriers can further improve performance of the complete ISO-C1/2.0 insulating system. Note that WA for different insulants is often measured by different ASTM Test Methods, making comparisons challenging. For instance, ISO-C1's WA of 0.47% was based on C272's a 24 hour period of immersion; the comparable cellular glass test per ASTM C240 yields a 0.2% WA from a 2 hour immersion period.

WATER VAPOR TRANSMISSION (WVT)

For optimum performance and longevity, insulation systems for low temperature applications must be designed to control condensation. One primary design strategy is to specify high insulation efficiency since if the surface temperature of the insulation system can be maintained above the dewpoint, condensation will not occur. Since a minimal amount of condensation may be acceptable (or unavoidable) in humid environments, a secondary design strategy is to also demand insulation with low water vapor transmission. In this regard, no other insulation alternative offers ISO-C1/2.0's combination of superior R-factor and low permeability of 2.49 perm-inch.

SURFACE BURNING CHARACTERISTICS

The International Mechanical Code defines Class 1 insulation as meeting the 25/450 flame spread/smoke development rating. ISO-C1/2.0 performs well within this range with a 25/250 rating. When comparing surface burning characteristics of alternative products, care must be taken to consider the installed insulation system as a whole. For example, a well-designed ISO-C1/2.0 insulation system can improve overall fire/smoke performance of the polyiso insulation system. On the other hand, cellular glass' fire/smoke ratings may be compromised by the use of the sealants or jacketing often recommended by suppliers. There is also the matter of insulation system integrity during a fire. ISO-C1/2.0 may be charred by flame, but maintains its integrity and continues to protect the insulated system.

For information on Dyplast Products or additional technical data on this product, visit www.dyplast.com.

ISO-C1/2.0 Polyisocyanurate Foam Comparison versus ASTM C591-17

GENERAL PHYSICAL PROPERTIES [1,2,3]	ISO-C1/2.0	ASTM C591 Max or Min
Service Temperature (Maximum[4]), °F (°C)	300 (149)	300 (149)
(Minimum)	-297 (-183)	-297 (-183)
12.1[7] Nominal Density, D1622, lb/ft^3 (kg/m^3)	2.02 (33)	≥2.0 (32)
12.2 Compressive Resistance (Strength), D1621, psi (kPa)		
Parallel	29.2 (201)	≥22 (150)
Perpendicular (Length)	26.8 (185)	Not specified
Perpendicular (Width)	18 (124)	Not specified
12.3 Apparent Thermal Conductivity, C177[8](aged 6 months @ 73 ± 4°F), Btu·in/hr·ft^2·°F (W/m·°K)		
Mean temp of measure -265°F (-165°C)	0.072 (0.010)	Not specified
Mean temp of measure -200°F (-129°C)	0.112 (0.016)	≤0.13 (0.019)
Mean temp of measure -150°F (-101°C)	0.133 (0.019)	≤0.15 (0.022)
Mean temp of measure -100°F (-73°C)	0.156 (0.023)	≤0.17 (0.025)
Mean temp of measure -50°F (-45°C)	0.180 (0.026)	≤0.19 (0.027)
Mean temp of measure -0°F (-17°C)	0.191 (0.029)	≤0.19 (0.027)
Mean temp of measure +50°F (+10°C)	0.183 (0.026)	≤0.18 (0.026)
Mean temp of measure +75°F (+24°C)	0.189 (0.027)	≤0.19 (0.027)
Mean temp of measure +150°F (+66°C)	0.232 (0.033)	≤0.23 (0.033)
Mean temp of measure +200°F (+93°C)	0.259 (0.037)	≤0.26 (0.037)
Apparent Thermal Conductivity, C518[9], aged +75F (+24C)	0.186 (0.027)	≤0.19 (0.027)
12.4 Hot-Surface Performance, C411, at 300°F (149°C) Deflection inches (mm)	Pass @ 0.15 (3.8)	≤0.25 (6)
12.5 Water Absorption, C272, % by volume	0.47	≤2.0
12.6 Water Vapor Permeability (Transmission), E96, Perm-in (ng/Pa·s·m)	2.59 (3.6)	≤4.0 (5.8)
12.7 Dimensional Stability[5], D2126, % linear change		
-40°F, 14 days	-0.8	≤1
158°F, 97% RH, 14 days	1.1	≤4
212°F, 14 days	0.4	≤2
12.8 Closed Cell Content, D6226, %	97	≥90
ASTM C591-17 COMPLIANCE	YES	

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12.9 Surface Burning Characteristics[6] (if required), E84		
	Flame Spread (@ 4 inch thickness)	<25
	Smoke Density (@ 4 inch thickness)	250
12.10 Leachable Chloride, C871, ppm		88
The following properties are NOT Specified for ASTM C591 but are often reported		
Shear Strength, C273, Average of 3 directions in psi (kPa)		21 (145)
Shear Modulus, C273, psi (kPa)		284 (1960)
Tensile Strength, D1623, psi (kPa)		
	Parallel	36 (250)
	Perpendicular	24 (165)
Tensile Modulus, D1623, psi (kPa)		
	Parallel	1601(11040)
	Perpendicular	928 (6400)
Flexural Strength, C203, psi (kPa)		
	Parallel	52 (360)
	Perpendicular	37 (255)
Flexural Modulus, C203, psi (kPa)		
	Parallel	590 (4070)
	Perpendicular	545 (3760)
Coefficient of Linear Expansion, E228, Average Value in/in °F (m/m °C)		35×10^{-6} (63×10^{-6})
Color		Tan

1. All properties were measured at temperatures at or near 75°F unless otherwise indicated, and all test values were obtained from independent certified testing laboratories.
2. These are nominal values obtained from representative product samples, and are subject to normal manufacturing variances.
3. Average value through the foam cross section of tested sample.
4. Above 300°F, discoloration and charring will occur, resulting in an increased k-factor in the discolored area.
5. Frequent and severe thermal cycling can produce dimensional changes significantly greater than those listed here. Special design considerations must be made in systems subject to severe cycling.
6. This numerical flame spread data is not intended to reflect hazards presented by this or any other material under actual fire conditions.
7. Table 1 includes the paragraph numbering system utilized within Section 12 of ASTM C591.
8. Thermal Conductivities (k-factors) at Low Temperatures: ASTM C591 is the Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal, and is arguably the key Standard used by insulation system end-users and engineer/specifiers to guide decision-making. Compliance with ASTM C591 is often a prerequisite within an insulation Request for Proposal. The latest versions of ASTM C591 impose some additional requirements such as revised limits on thermal conductivities (k-factors) measured across a temperature range from +200°F to -200°F. Dyplast has traditionally offered this information to its clients; our k-factor results are compliant and excellent.
9. Quote from ASTM C177: "5.9 The results of comparative test methods such as Test Method C518 depend on the quality of the heat flux reference standards. The apparatus in this test method is one of the absolute methods used for generation of the reference standards. The accuracy of any comparative method can be no better than that of the referenced procedure. While it is possible that the precision of a comparative method such as Test Method C518 will be comparable with that of this test method, Test Method C518 cannot be more accurate. In cases of dispute, this test method is the recommended procedure."

FEATURES AND BENEFITS

Dimensionally stable; Superior insulating value; Excellent Moisture Resistance; Easy to handle, shape in the field; Sheets can be cut to 1/32" tolerance; Variable bunstock sizing in 3 dimensions; Fabrication flexibility to virtually any shape/size; Environmentally friendly (Zero-ODP); High flexural strength; Chemically resistant; Low life-cycle cost; Light-weight.

APPLICATIONS

Pipe, tank, vessel mechanical insulation; Panels for refrigeration and freezers; Core material for architectural and panelized construction; Panel insulation for shipping containers and rail cars; Flat panels for duct and air plenum insulation.

INDUSTRIES

Refrigeration/freezer manufacture; Commercial HVAC and chill water systems; low temperature steam; hot water; LNG, LOX and other cryogenic facilities; Commercial building construction; Refrigerated transportation.

INSTALLATION

When using ISO-C1 as part of an insulation system with vapor barriers, mastics, and jacketing, Dyplast recommends that vapor barriers be factory applied by an authorized fabricator, with mastics and jacketing applied in the field. (See Dyplast's Installation Guidelines)

ASTM C591-17

MIAMI-DADE COUNTY

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Identified Component
Combustible Core Insulation

COMPLIANCES AND APPROVALS

ISO-C1/2.0 has been tested by independent laboratories to meet or exceed the requirements of the ASTM C591-17. Also:

- Listed under FM Approval Standard 4880 for use in Manufactured Wall and/or Ceiling Panels
- Recognized as a Specified Tested Identified Component Insulated Building Panels.
- Independently audited by FM as per the 4880 Surveillance Audit Program
- received a Notice of Acceptance from Miami-Dade. More information on certifications is available on our website, as well as SDS information, specifications, installation guidelines, and other technical information.

DISCLAIMER OF WARRANTIES AND LIABILITIES

Dyplast Products, LLC ("Dyplast") warrants that all products manufactured and sold by us are free from defects in material and workmanship at the time of shipment. Dyplast shall be notified promptly of any material claimed defective and such materials shall be subject to inspection by Dyplast. With respect to material proven to be defective, Dyplast will replace any material; replacement will be CIF to the buyer's location. This warranty is given in lieu of all other warranties expressed or implied, including without limitation any warranty of merchantability or fitness for a particular purpose and all other such warranties are expressly disclaimed. In no event shall Dyplast be liable, under this warranty for special, incidental, punitive or inconsequential damages of any kind whatsoever arising from the use or installation of the materials sold hereunder, and Dyplast's liability under the above warranty shall be expressly limited to the cost of those materials proven to be defective. In no event, whether as a result of breach of contract, warranty or alleged negligence shall Dyplast be liable for damages for lost profits or revenue, claims of Dyplast's customer's or their customer's inability to operate their facilities, or any other item of special incidental, punitive or consequential damages.

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